Original Article

# Prevalence of Obstructive Sleep Apnea using Stop Bang Questionnaire - An Observational Study

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## ABSTRACT

**OBJECTIVE: To estimate the prevalence of obstructive sleep apnea (OSA) using the STOP BANG questionnaire in Coimbatore city, Tamil Nadu, India.**

**METHODOLOGY: An observational study was conducted with 203 participants in Coimbatore city from August 2024 to October 2024. A simple random sampling technique was used to recruit the participants. Both males and females aged 18 or older were included in the study. Coronary artery disease, COPD, and anatomical defects of the upper airway were excluded from the study. Informed consent was obtained, and they were asked to complete the STOP BANG questionnaire. The prevalence of obstructive sleep apnea is estimated from the total score obtained on the STOP-BANG questionnaire. Descriptive statistics, such as Mean, Standard deviation, and percentages, were used to analyze the data in this study.**

**RESULTS: The mean age of the participants was 45.6±13.1 years; the mean BMI was 29.1±6.4; The mean neck circumference was 38±8 cm. OSA is more common in males than in females. The prevalence of obstructive sleep apnea is 13.9%.**

**CONCLUSION: This study revealed the prevalence of obstructive sleep apnea, highlighting the importance of public awareness of the disorder and informing management planning.**


**KEYWORDS: Obstructive sleep apnea, OSA, Prevalence, Sleep, STOP BANG questionnaire, Upper airway**

## INTRODUCTION

Obstructive sleep apnea (OSA) is a recognized sleep disorder in which narrowing of the upper airways occurs in sleep. The proposed risk factors are male Gender, change in jaw bone, short neck, nasal congestion, decreased upper airway muscle activity, and obesity. Ethnicity affects the prevalence of OSA. Spanish people and Asians are at risk of OSA. Obstructive sleep apnea is caused by the relaxation and collapse of muscles in the back of the throat. Changes in bony configuration or changes in soft tissues around the area can alter the size of the airway. Cessation of breathing or a decrease in airflow occurs during sleep in a few people due to airway collapse. Sleep-related decreases in the function of dilator muscles affect the protective dilator reflexes. Though the cross-sectional area decreases, the length of the airway increases, which predisposes it to collapse. The upper airway lacks rigid structure, and that makes it easily collapsible. These compromised reflexes are insufficient to maintain patency of the compromised airway. All these changes obstruct the airways.

Partial obstruction causes snoring, and complete obstruction causes cessation of breathing. The symptoms of OSA are snoring, disturbed sleep, excessive daytime sleepiness, headache, etc.; Snoring is often ignored in Indian society. As snoring is the primary symptom, most of people with sleep apnea are not diagnosed. Only 2% of people with OSA go for consultation. The prevalence of OSAS was estimated as 3.6% by a study conducted in North India[1]. Another study assessed the prevalence of obstructive sleep apnea in India as 13.7% and found no statistical difference across age groups, and showed that males had a higher prevalence than females[2]. Several complications arise due to OSA. Hypertension, cardiovascular diseases, increased insulin resistance, memory problems, difficulty in concentration, stroke, increased road traffic accidents and industrial workplace are a few among the complications. The occurrence of OSA in the general population and the complications such as Hypertension, cardiovascular diseases, heart failure, and strokes should warn healthcare providers to early diagnose and treat sleep-disordered breathing as well as prevent them[3].

Findings from a systematic review emphasize the need to include OSA assessment and treatment in


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overall health care. Early screening can prevent further consequences. The waiting periods for sleep studies are prolonged even in developed countries[4,5]. The American Academy of Sleep Medicine does not define the best method for estimating the probability of OSAS. The STOP-Bang questionnaire is an easy, effective screening tool for sleep apnea. This questionnaire covers the significant risk factors and symptoms of OSA. The overall score of the questionnaire calculates the risk of OSA. This questionnaire is a valuable screening method for OSA in the general population[6]. As there are several complications of obstructive sleep apnea, there is a need to estimate the prevalence of the disease. Knowledge of the disease is essential to plan health promotion programs as well as management. This study aims to assess the prevalence of obstructive sleep apnea using the STOP-BANG questionnaire.

## METHODOLOGY

This observational study was conducted at Coimbatore City, Tamil Nadu, India, from August to October 2024. Population: Ages above 18 years and both genders were included in the study. Participants were recruited from Coimbatore city using a computerized random sampling method. The sample size was calculated by

$$n = \frac{Z^2(1-P)}{d2}$$

Where n is the sample size, Z is the statistic corresponding to the level of confidence, P is the expected prevalence, and d is the precision. People with coronary artery disease, COPD, and anatomical defects of the upper airway were excluded from the study. Participants were informed about the study. Informed consent was obtained from the participants. A questionnaire was explained to interested participants, and they were asked to complete the STOP BANG questionnaire. The Institutional Review Board of KMCH College of Physiotherapy approved the study. For the expected prevalence of 13.7% [2], the required sample size is/was 203 to achieve a margin of error (absolute precision of ±5% in estimating the prevalence with 95% confidence, accounting for a potential loss/attrition of 10%. With this sample size, the anticipated 95% CI is/was (8.7%, 18.7%). This sample size is calculated using the Scalex SP calculator [7]. IBM SPSS 23 software was used to calculate descriptive statistics. Mean, standard deviation, and percentage were the descriptive statistics used in this study.

## RESULTS

Snoring: Loud snoring was reported by 19.5% of men and 3% of women. Tiredness: 10.1% reported excessive sleepiness. Observed apnea was 7% and Hypertension was present in 12% of the participants.
BMI:18.4% of them were obese. The mean age was 45.6±13.1 years. The prevalence was high among people aged 50 and older. The mean neck circumference of the participants was 38±8 cm. Increased neck circumference was noted independent of body weight. One hundred two males and 101 females participated in the study.
The interpretation is based on the calculation of the scoring of the STOP-BANG questionnaire. If Yes is answered to 5-8 questions, they are categorized as high risk. The calculated prevalence of OSA using the STOP-BANG questionnaire is 13.9% with a 95% confidence interval.

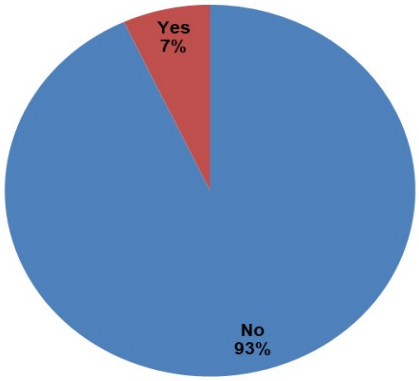


**FIGURE 1: Apnea during sleep**

**Table I: Variables data**

| Variables | Values |
|---|---|
| Total number of patients | 203 |
| Male: Female | 50.24:49.76 |
| Mean age | 45.6±13.1* years |
| Mean BMI | 29.1±6.4* |
| Mean neck circumference | 38±8* cm |

**Mean±Standard deviation*

## DISCUSSION

Due to increased morbidity and mortality of untreated OSA, it is essential to diagnose it at the earliest. A meta-analysis done by Nagappa M et al.[8] confirmed the validity of the STOP-Bang questionnaire for screening of OSA. If the score of STOP-Bang is high, the probability of moderate OSA and severe OSA is also high.
The components of STOP are snoring, tiredness, observed cessation of breathing and increased blood pressure. Snoring is the first reported symptom by either the patient or bed partners. Turbulence created by the opening of a collapsed airway produces snoring[9]. Bed partners usually notice loud snoring. Tiredness, the next component of the STOPBANG questionnaire, is perceived during the day due to sleep fragmentation. Though sleepiness is considered the main feature, many patients with OSA use tiredness as a symptom. A study of 190 patients with OSA confirmed by sleep study found that fatigue and tiredness were the main complaints rather than sleepiness[10]. Frequent arousals during sleep lead to

daytime sleepiness. Observed apnea in sleep by someone is due to the inability of dilators to maintain patency. Tonic activity of the tongue and palatal muscles contributes to the size and stiffness of the airway, which decreases in sleep. The next component is high blood pressure. Blood pressure is elevated in patients with OSA. Apnea, hypopnea, and restoration of airflow may affect multiple pathways that regulate blood pressure (BP) during the night and, in turn, influence daytime Blood Pressure also[11]. Sympathetic tone is increased, and elevated systemic blood pressure during arousals may lead to vascular remodelling and changes in endothelial function. Those with more than 15 arousals per hour due to obstruction in sleep were more likely to develop Hypertension. There is an increased risk for cardiovascular morbidity and mortality if they do not receive any treatment.

BANG stands for BMI, Age, Neck circumference, and Gender (male). Lifestyle changes increase the prevalence of obesity. The increasing rate of obesity increases the prevalence of OSA, which ranges between 14% and 55% [12]. The transmural pressure across the pharyngeal airway is a crucial factor in maintaining the patency of the upper airway. Obesity leads to greater negative transmural pressure, which predisposes to upper airway collapse. The next factor is age. Loss of tensile tissue strength and decreased lung elastic recoil occurs with aging. The protective reflexes are also reduced. The percentage of high risk of OSA is 13.9% and it increases with advancing age. Aging changes the pharyngeal anatomy and biomechanics and decreases the function of pharyngeal dilators[13]. The prevalence in adults ranged from 6% to 17%, reaching 49% in older adults, as concluded from the systematic review by Senaratna CV et al.[14].

Greater neck circumference increases the risk of OSA. The frequency of snoring, as assessed from sleep studies, and neck circumference were positively correlated with the Apnea-Hypopnea Index among adults and suggested that neck circumference might be a better parameter than BMI and ESS for OSA prediction[15]. The thickness of the tongue and the lateral pharyngeal wall is increased in OSA patients, and the higher the thickness, the greater the likelihood of OSA, irrespective of BMI and neck circumference. A study suggested that sub-mental ultrasound may be beneficial to diagnose severe OSA patients in settings where resources are limited[16]. A study by Prasad CN in an Indian setting found that the prevalence of OSA ranged from 4.4 to 13.7%.

Among males, it ranged from 4.4% to 19.7%; among females, from 2.5% to 7.4%. A systematic review done by Senaratna et al. [14] confirmed that the prevalence of OSA is increased with advancing age, males, and people with overweight. The apneic threshold is higher in males than in females due to male hormones. Obese Males are at high risk of having OSA, and it is noted that Hypertension and ischemic heart disease are complications of obstructive sleep apnea[17]. In older adults, the negative-pressure reflex was significantly reduced. And increased para-pharyngeal fat deposition in both sexes; in women, the soft palate is lengthened, and there is a change in the bony shape surrounding the pharynx, and also mentioned that the fat deposits around the airway are independent of age-related changes in body fat[18].

The prevalence calculated from the overall score was 13.9%. Our findings also fall in the same range as those of previous studies. A study on the worldwide population reported that 1 billion people are affected by OSA and calls for effective measures to reduce the negative impacts [19]. When the data were collected, most of the participants did not consider snoring a problem at all and said it was very common among men. An increase in body weight and neck circumference due to a sedentary lifestyle increases the risk of OSA.

Strengths and limitations:

The equal participation of males and females in the study is a strength of the current study. Limitations of the study include the lack of objective measurements, such as polysomnography, and an equal distribution of age groups.

## CONCLUSION

The percentage of presence of high risk for obstructive sleep apnea is 13.9%. Knowledge of the prevalence of Obstructive Sleep Apnea will help healthcare professionals conduct regular screening for OSA and educate patients about its various consequences. Future studies can be performed using sleep studies and screening of OSA in the COPD population and among drivers.

**Ethical permission:** KMCH College of Physiotherapy, KMCRET, Coimbatore, Affiliated to the Tamil Nadu Dr. MGR Medical University, Chennai, India, IRB letter No. 01/IRB/2024.

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**Data Sharing Statement:** The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

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## AUTHOR CONTRIBUTION

Kalpana AP: Contribution in study design, concept, literature search, data collection, data analysis & interpretation and drafting

Kannabiran B: Contribution in study design, concept, literature search, data collection, data analysis & interpretation and drafting

Franklin S: Contribution in study design, concept, literature search, data analysis & interpretation and drafting
Sivakumar S: Contribution in study design, concept, literature search, data analysis & interpretation and drafting

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